UT-BATTELLE

Techniques for Successful Project Management – Lessons Learned from the Spallation Neutron Source

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The Spallation Neutron Source (SNS) Achieved world-class objectives!

- **Construction completed on schedule (June 2006) under budget ($1.411B)**
- **World's leading facility for neutron science**
- **Room for eventual 25 instruments spanning physics, chemistry, biology, and materials science**
- **Upgradeable to higher power, second target**

SNS at ORNL: before (1998)

SNS at completion (2006)

Numerous Challenges for the Project

- **Expertise required to design/construct this large accelerator differed from the extensive reactor-based experience at ORNL**
- **Safety had to be sustained during years of intense, major construction**
- **Needed to transfer construction technical expertise to operating staff**
- **Technical, cost, and schedule objectives had to be achieved**

Rigorous project management was mandatory

Lesson Learned #1
Build strong project leadership team early

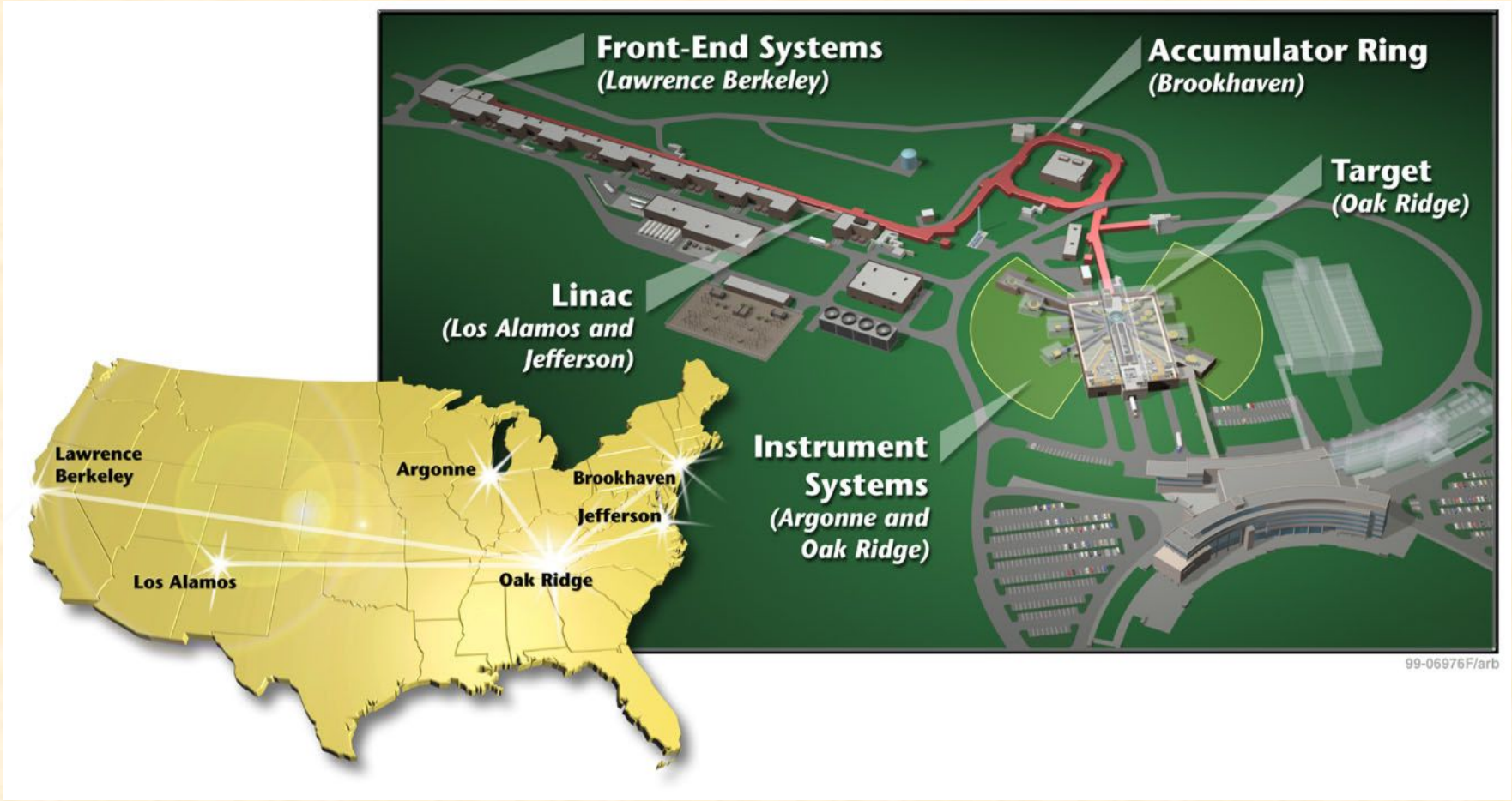
- **Project management team must be highly credible**
  - **Experienced professionals**
  - **Must possess project (vs. program) mentality**
  - **Project and team builders**
  - **Communicators**
  - **Decision makers**
  - **Strong dedication to the end goal**
  - **Chief schedule driver**

Time is money!

- **Throughout the project, SNS maintained (and measured against) an aggressive schedule**
- **High degree of concurrency**
  - **R&D, design, civil construction, installation, and commissioning were going on (in different areas) simultaneously**
- **Risks of parallel work can be managed to avoid the greater cost and schedule impacts of waiting**
  - **2 years and ~300M$ if work performed in series**

High quality, capable project staff also essential

Partnerships were formed with multiple institutions

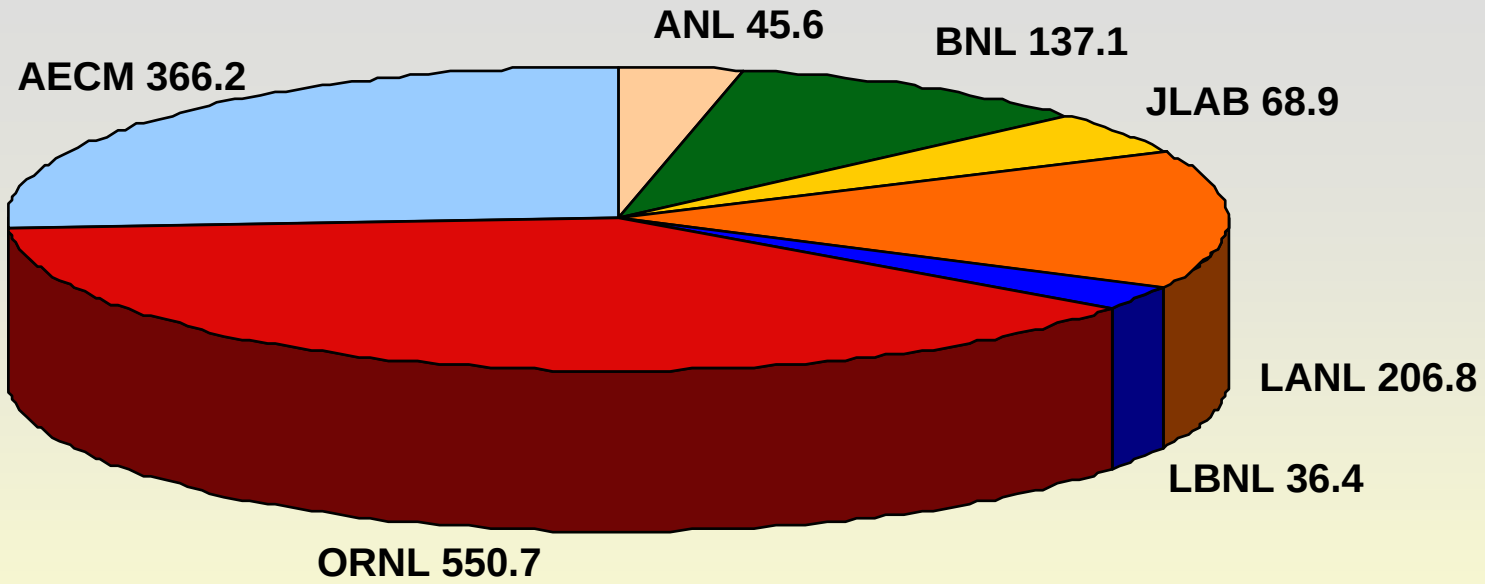


SNS was organized as if single institution

- **Simple, uniform Memorandum of Agreement among participating laboratory directors defined ground rules**
- **Permitted SNS project management to deal directly with SNS management staff within each lab**
  - **Ensured management roles at partner laboratories filled by staff with proven project management experience as well as technical experience**
  - **Allowed input to annual personnel performance evaluations**
  - **Established formal SNS performance criteria within each lab's operating contract with DOE that could affect each lab's annual fee**

SNS partners owned major scope, budget, and risk!

Total Project	$1411.7M



Legend

- Argonne National Laboratory
- Brookhaven National Laboratory
- Thomas Jefferson National Accelerator Laboratory
- Los Alamos National Laboratory
- Lawrence Berkeley National Laboratory
- Oak Ridge National Laboratory
- Architect Engineer/ Construction Manager

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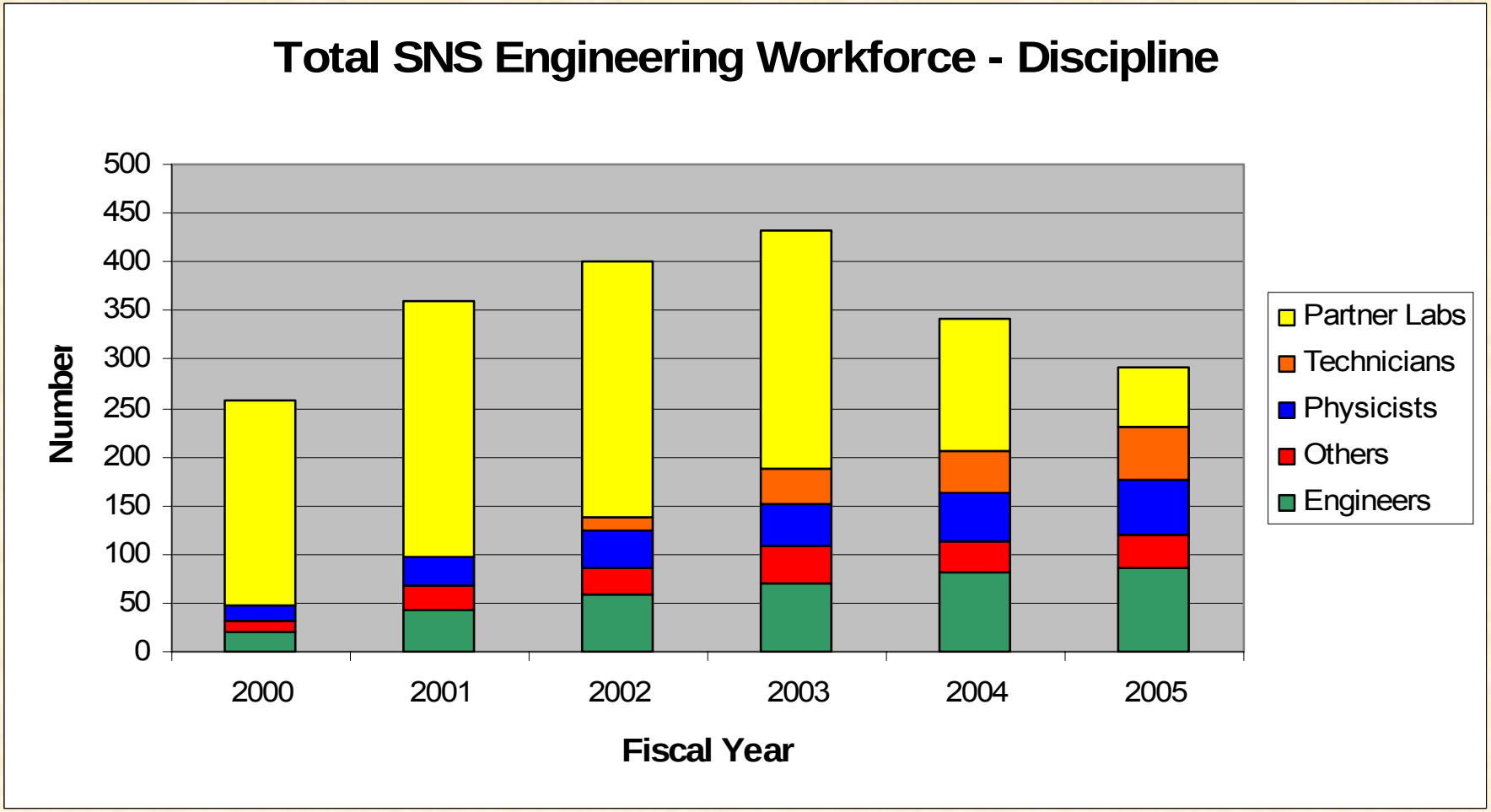
Lesson Learned #2
Multi-lab and industrial partnerships can be successfully used

Key roles of central project management team were:

- **Focal point for coordination, oversight and direction**
  - **Decisions needed to equally respect the needs of the overall project and each of the partners**
- **Strong systems integrator**
  - **Requirements definition, interface definition, configuration and document control, and integrating activities (design reviews, installation)**

Multi-lab approach allowed slower, deliberate ramp-up of operating staff



But, leading large collaborations adds another dimension...

- **Trust at all levels, open communications, and constructive criticism is a must**
- **Management at each partner organization must make the commitment and accept institutional ownership and accountability**
- **Need to rely on technical and procurement specialists within each lab to manage their hardware procurements**
- **Development of performance incentives for construction contractors helps achieve safety, schedule and cost objectives**

Lesson Learned #3
Innovative HR programs key for successful recruiting/retention of staff

SNS implemented DOE pilot program

- **Provided project-level authority to act**
- **Introduced or enhanced variable pay options for key personnel at ORNL and partner laboratories**
  - **Recruitment/assignment bonus – means to rapid relocation**
  - **Incentive performance award – serves as a retention tool**
- **Service recognition applied to specified benefits for inter-laboratory transfers**

Lesson Learned #4
Many project management tools and processes are needed to manage project performance

- **Constant, unrelenting control of cost/schedule using disciplined management systems**
- **Systems should be:**
  - **Implemented early**
  - **Useful**
  - **Not overly complicated**
- **Accountability must be placed with the line managers**

Top level oversight must be on-going

- **Dispassionate performance assessment**
  - **Details, details, details**
  - **Demand the analysis needed**
  - **Evaluate, don't just monitor**
  - **Believe the indicators anticipate problems, manage changes proactively -- force action**
  - **Ensure performance indicators from all sources (safety, cost, schedule, staffing….) are integrated**
  - **Keep your eye on the ball (current end-point cost estimate, schedule, and risk assessment)**

Risk Management is a critical component

- **Must plan for known risks plus potential impacts of unknowns**
- **“Higher risk” technical innovations received management attention early, but risks in low-tech areas can not be dismissed**
- **Centrally-managed contingency fund is an effective risk mitigation approach**
  - **Build up from “embedded contingency” in partners’ plans**

Regular, candid advice is extremely valuable

- **SNS Project strongly supported regular, disciplined external reviews on all aspects of the project**
- **Value added**
  - **“Peer pressure” strong motivator**
  - **Allows sharing of knowledge and expertise to identify issues and resolve problems**
  - **Excellent tool for understanding and managing risks**
  - **Benefits accrued from preparing for formal reviews**

Lesson Learned #5: Safety requires unrelenting attention by management, and.....

- **Management Driven**
  - **Emphasis instilled from the beginning**
  - **Commitment from DOE, ORNL, Construction Manager and subcontractors that safety is #1 priority**
  - **Only contractors with good safety records can bid**
  - **“White Hat” oversight**
  - **Construction Manager Corporate and insurance company inspections**
  - **Track and trend precursor events**

Safety requires unrelenting attention by the workforce

- **Workforce Friendly**
  - **On-site nurse's station for quick attention; also available for non-work related injuries**
  - **Maintain environment that encourages event reporting**
  - **Frequent "celebrations" to recognize workers**
  - **Crafts participate in work process development**

In Summary,

Overall Status

Using disciplined project management processes, SNS construction completed on time, within budget and exceeded initial technical scope


Night view of the Central Lab and Office Building

Model Partnership

The multi-laboratory SNS partnership is a model for future large science projects

•Other projects , including international collaborations, borrowing SNS management systems

Bright Future

Projects are stressful and exhausting……..

But, there is great reward in seeing science being done!!